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13. ABSTRACT (Maximum 200 words) Two projects were completed under this grant. The first project examined how coastal terrain interacts with prevailing winds along the southern California coastline. We determined that under northwest flow, wind fields followed a systematic pattern governed by basic hydraulic flow theory. Land surface heating disrupted this pattern during the night by forcing an offshore flow, thereby creating regions of weak winds over the Santa Barbara Channel. Our second project examined how turbulence is forced in the coastal ocean. We utilized a large-eddy simulation model to examine how turbulence is forced by current motions over bottom terrain features and by frontal zones. Model results show that relatively small bottom features can drive large internal wave momentum flux, forcing a current drag that does not rely on active turbulence and is therefore not present in current turbulence parameterizations. We evaluated a set of three turbulence parameterizations in a coastal ocean model and determined that each model produced consistent results except near frontal zones during downwelling events.				
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FINAL TECHNICAL REPORT

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Eric D. Skillingstad and Hemantha Wijesekera

Turbulence off the Coast of Oregon: A Large-Eddy Simulation Study.

Modeling of the Atmospheric Circulation in the Santa Barbara Channel

This report describes two projects that were completed under the same grant. The objective of the first project was to determine how local, coastal wind fields in the Santa Barbara Channel (SBC) region are affected by slowly varying synoptic weather conditions and diurnal heating. We found that mesoscale models are capable of providing accurate predictions of the marine boundary layer structure in regions of complex terrain. Simulations of the flow around Point Conception show that the flow is strongly affected by the diurnal heating cycle when winds are from the northwest (the prevailing direction in the summer). Model results and observations show a consistent pattern of strong NW winds in the afternoon that fan out over the Santa Barbara Channel in a hydraulic response to the presence of the point. Land surface cooling at night causes a weak offshore flow that disrupts this pattern, leading to a transition in the hydraulic flow response and reversal of the surface winds over the channel.

Our second project concentrated on parameterization of turbulence in the coastal ocean. We used a large-eddy simulation model to examine how turbulence is generated by surface wind and waves and obstacles on the ocean bottom. We found that ocean fronts can have a significant impact on near surface turbulence by altering the buoyancy production of turbulence. Obstacles on the bottom are found to generate strong internal wave drag if the bottom boundary layer is weak. High bottom friction decreases the strength of this wave drag by decoupling the near bottom flow from the rest of the water column.

Comparisons of mixing schemes (Mellor-Yamada or M-Y, k - ϵ , and K-profile) used in coastal models show similar behavior between the different approaches. Differences between the schemes is most evident in the frontal region near the shore. The M-Y scheme shows buoyancy production during downwelling while k - ϵ shows shear-driven mixing.

PUBLICATIONS

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